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Smart and Ingenious Terrace Farming

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ABSTRACT:The world is having two major problems. Lack of greenery and space. Food is a vital part in survival. Without farming, it would be very difficult for us to spare the food we have. But the problem we are facing is the reducing space for farming. With growing populations, the amount of land available is decreasing. To overcome this problem, we have terrace farming. And this farming involves the best use of technology. Watering crops timely, measuring temperature and humidity, providing artificial light in dark and even providing no water when there is rainfall all in one compact device. All this data can be monitored through a mobile app.

I. INTRODUCTION

Amount of food resources are not able to cope up with the increasing population of humans. Mumbai for instance, is a large city. But it is so dense that there is almost no area for more agriculture. However, there is enough area to fulfil the needs for food by the means of terrace farming. We can utilize all this empty terrace land for providing food and oxygen to the world. Additionally, anyone can grow vegetables at their own terraces without worrying to maintain any of it.

1.1 PROBLEMS OF CONVENTIONAL FARMING

- 1) Requires a lot of land
- 2) Too much maintenance is required for the crops and vegetables grown
- 3) Pesticides and Insecticides used harm the environment
- 4) Soil starts becoming infertile and loses its nutrients

1.2 BRIEF INFORMATION ABOUT THE PROJECT

This project uses various sensors for maintain the growth of plant and vegetable. It measures the temperature, humidity and barometric pressure and shows it right in the app. The project includes a light dependent resistor that emits light of a specific colour, depending on the plant. The rain gauge sensor detects rainfall and doesn't supply water to the plant while it is raining. All this data is received by the microcontroller, NodeMCU, which is a wi-fi board. Through wi-fi and a mobile app it connects to your smartphone and shows you all the data that is recorded.

II. BLOCK DIAGRAM

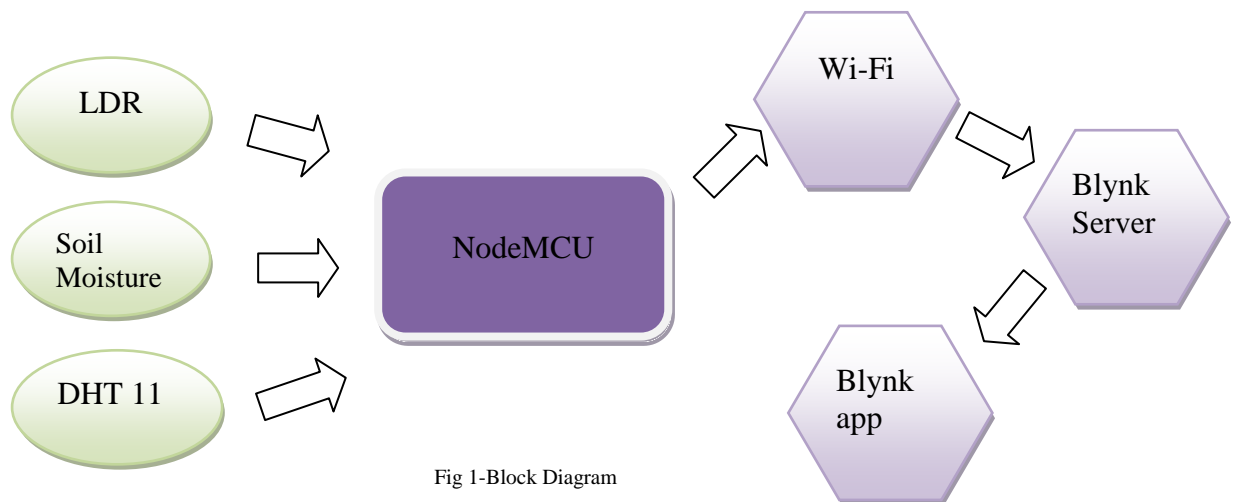


Fig 1-Block Diagram

III. COMPONENTS USED

Microcontroller – A microcontroller consists of the main processing and controlling unit of the system. All the input and output devices used in the system are interfaced to the Input / Output (I/O) pins of the microcontroller and the program for execution is stored in the memory of the microcontroller. The microcontroller used in the project is ESP32. The controller has up to 520 KiB of memory to store instructions, 8-bit processing unit and 10 pins interfacing pins for external modules. Fig 2 shows the microcontroller which we have used.



Fig 2- Microcontroller- Collects data from sensors and controls other devices

Light Dependent Resistor – An LDR is a component that has a resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits. The resistance of the photoresistor decreases with increasing light intensity. It is used light activated or dark activated switching circuits.

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Fig 3 – Light dependent resistor. Inputs when it is dark.

DHT 11 - The DHT11 is a basic, ultra-low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). It's fairly simple to use, but requires careful timing to grab data. It calculates both temperature and humidity.

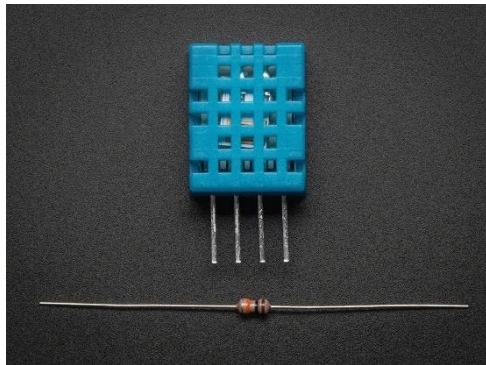


Fig 4 – DHT11 – Informs the microcontroller about the temperature and humidity

Soil Moisture Sensor - The Soil Moisture Sensor uses capacitance to measure the water content of soil (by measuring the dielectric permittivity of the soil, which is a function of the water content). Simply insert this rugged sensor into the soil to be tested, and the volumetric water content of the soil is reported in percent. Soil with more water conducts more electricity, so the sensor will detect more amount of water. Similarly, dry soil would conduct electricity poorly, so the sensor would detect less amount of water.

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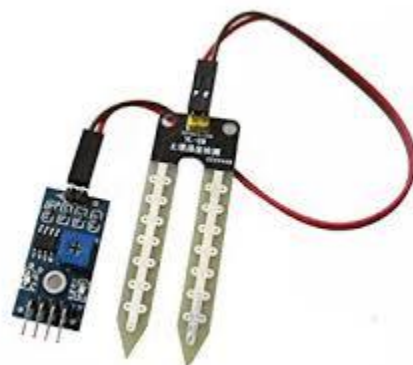


Fig 5 – Soil Moisture Sensor – Sends input to water the crops when the soil is dry.

BMP280 Sensor – BMP280 is an absolute barometric pressure sensor especially designed for mobile applications. The sensor module is housed in an extremely compact package. Its small dimensions and its low power consumption allow for the implementation in battery powered devices such as mobile phones, GPS modules or watches.



Fig 6- BMP280 - Sensor for determining barometric pressure

RAIN GAUGE SENSOR–Rain gauge sensor is basically a board on which nickel is coated in the form of lines. When rain falls on it, the rain water will conduct electricity between these lines and will give an high output.

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Fig 7- Rain sensor

IV. IMPLEMENTATION

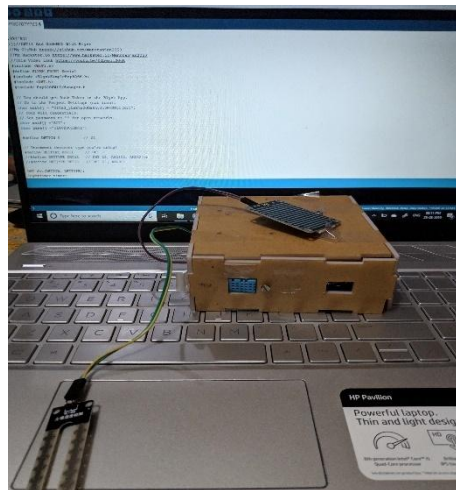


Fig8-PrototypeoftheProject–The brown compact box contains all the required sensors for the project.

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```
File Edit Sketch Tools Help
[Icons]
PROTOTYPE2$
float h = dht.readHumidity();
float t = dht.readTemperature(); // or dht.readTemperature(true) for Fahrenheit

if (isnan(h) || isnan(t)) {
  Serial.println("Failed to read from DHT sensor!");
  return;
}

Blynk.virtualWrite(V5, t);
Blynk.virtualWrite(V6, h);
}

void setup()
{ dht.begin();

  // Setup a function to be called every second
  timer.setInterval(1000L, sendSensor);
}

void loop()
{ delay(200);
  Blynk.run();
  timer.run();
  if (( ( digitalRead(2) ) == ( LOW ) ))
    ((digitalWrite( 13 , LOW ))); //pump motor

  if (( ( digitalRead(16) ) == ( LOW ) ))
    ((digitalWrite( 15 , LOW ))); //led
  }
}
```

Fig 9 - A sample of the program code which was running the prototype.

V. FUTURE ENHANCEMENTS

We can develop our project by adding the ability to spray natural fertilizers on the plants when needed. This prevents any destruction of crops. Also, natural fertilizers will not trigger any health or environment hazards. We can also add cameras for improved security at night. As terraces are a major entry point for this simply adding cameras and motions sensors will alert residents.

VI. CONCLUSION

The project is all about how everyone can contribute to supply the world food and oxygen. People just need to install this on their terraces and with no effort at all, they are set to go. Even with the reducing space we can utilize terraces to provide food and save our earth.

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- [2] <https://opensource.com/article/17/3/arduino-garden-projects>